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EXAMINER
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PADGETT, MARIANNE L

ART UNIT	PAPER NUMBER
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1715

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/018,727	<b>Applicant(s)</b> WILLIS ET AL.	
	<b>Examiner</b> MARIANNE L. PADGETT	<b>Art Unit</b> 1715	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 June 2010.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 28, 30, 43 and 44 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 28, 30, 43-44 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)         | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)         | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                          |

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1. Applicants' **amendment of 6/15/2010** has canceled claims 29 & 31-42, thus removed 112 first & second problem is discussed with respect to those claims in the action mailed 12/15/2009.

Applicants have also amended independent **claim 28** so as to positively recite that the glycidyl methacrylate is vapor in the pulsed plasma discharge, with positive recitation that the polymer growth on the surface of the substrate is a "coating having epoxy groups", thus clarifying issues with respect to these aspect of the pulsed plasma deposition.

2. **Claims 28, 30 & 43-44** are rejected under 35 U.S.C. **112, second** paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Independent **claim 28** has been amended to add the limitation "where in the pulsed plasma discharge is achieved by a plying **a power pulse** to the plasma" (emphasis added), which pulls is indicative of applying a single pulse, but does not exclude multiple pulses been employed for achieving the pulsed plasma, however given the claimed possibility of a single pulse, it is unclear if one could actually call a plasma produced by a single pulse, a "pulsed plasma discharge", as this terminology generally refers to application of multiple pulses, with it further unclear how one would calculate an average power density, as one cannot calculate an overall period, i.e. OFF time between pulses, when there is only a single pulse. Note that this problem considerably impacts dependent **claim 30**, since the possibility of employing a single pulse "over a **period** from 30 seconds to 20 minutes" (emphasis added) could be a single pulse over that time, or a pulsed + off time (unknown ratio ON/OFF) or multiple pulses if "period" actually means time generically & is not employed in the sense of a cycle, i.e. claim 30 is further ambiguous. Note that there is a considerable difference in scope in claiming "applying a power pulse" from claiming, for instance -- applying a pulsed power -- it (consistent with disclosure on page 6 of original specification), as the latter does not create the ambiguities of the former, as it is entirely

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consistent with the creation of a pulsed plasma discharge, not explicitly suggesting using only a single pulse.

New independent **claim 44** has been submitted, which corrects various antecedence problems as discussed in the previous action with respect to now canceled dependent claim 42, however the preamble of this independent claim is directed to a method "for mobilizing eight nucleophilic reagent at a surface of a solid substrate", and while the substrate surface now clearly has the claimed coating having epoxy groups thereon where the nucleophilic reagent reacts with the epoxy groups of the coating, but a reaction does not necessitate that any immobilization of the nucleophilic reagent takes place, as it is inclusive of reactions that etch, i.e. do not bond to the substrate, via the oxygen group of the epoxy or otherwise. Hence, the preamble of this claim is not commensurate in scope with the body of the claim, such that the actual scope of the claim is unclear, i.e. whether the scope encompasses any possible reaction with the epoxy group, or should actually require immobilization of the preamble to occur. Note dependent claim 43, now dependent from claim 44, does not correct this problem.

3. **Claims 28 & 30** are rejected under 35 U.S.C. **112, first** paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Note that the above discussed ambiguities caused by claiming possibly a single pulse of power in the independent claims, particularly where that pulse has a period of 30 seconds-20 minutes of dependent claim 30 must be considered to encompass New Matter, as is consistent with the evidence as was set forth in section 3, on page 4 of the action mailed 12/15/2009.

4. The examiner has re-reviewed the **declaration** of 2/13/2009 by Dr. Stephen Colson in view of the amended claims, and while the clarifications (vapor & epoxy group limitations) in the independent claim makes the claims more commensurate in scope with examples in the original

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specification, in presumably with the incompletely described experiments in the declaration, the issue remains that a mere two data points, one of which is insignificantly different than the claimed range of average power densities (less than  $0.0025 \text{ W/cm}^3$ , which encompasses  $0.002499999$  that rounds to the "outside" Data point), so can not be considered to show any significant falling off "outside" the claimed range, since the declaration provides essentially **no conclusive information** on the behavior significantly outside the claimed range, nor can a mere two data points, even if one was significantly outside the claimed range, determined where the drop-off takes place, as there is no indication of whether a straight-line relationship occurs between two points or some curve that truly has a substantial falling of a percentage of epoxy functionality at some power density that cannot be determined from the two points provided.

If it applicants are able to provide experimental data that actually demonstrated the conclusion of section 7 of the 2/13/2009 declaration, which conclusion is unwarranted for the two data points submitted, then the later provided opinion on routine experimentation could be considered to have some weight. However, at present, an increased retention at a lower power density than a power density 10 times greater, which is essentially at the start of the claimed range, cannot be considered by a responsible examiner to show a substantially falling off outside the claimed range, especially as the preponderance of the prior art clearly suggests higher retention rates for reactive functional groups in general when lower versus higher power densities are employed, with the power densities optimized according to particular monomers & functional groups. Lacking sufficient data, the two submitted data points can only be considered to show a generally expected trend, without showing at about what power density, if any, a significant change in retention occurs (i.e. thus whether the claimed process is limited to unexpected results), especially considering there is a lack in information on other plasma parameters employed in obtaining the two experimental data points up the declaration (e.g., type of plasma [microwave, RF, dual frequency,...]; plasma pressure; vapor flow rate or partial pressure of GMA; time; etc.) that may also

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affect the plasma polymerization process & the retention rate of desired epoxy groups when depositing GMA, making a mere two data points even less significant with respect to the actual scope of all pulsed plasmas claimed, in making the conclusions that may appropriately be drawn from the presented data even less significant.

Also see section 11 of the action mailed 12/15/2009 which has a detailed discussion of the 12/13/2009 declaration, including opinions expressed therein, hence the "opinions" were not merely dismissed, but carefully considered by an examiner who has worked over 20 years in the field of plasma depositions. A declaration needs to have sufficient hard evidence to support its conclusions & opinions, and that evidence needs to be consistent with the scope of the claims, in order to provide a responsible examiner with sufficient evidence to conclude patentable significance.

5. The following is a quotation of 35 U.S.C. **103(a)** which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The **nonstatutory double patenting rejection** is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct

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from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. **Claims 28, 30 & 43-44** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Connell et al** (UK 1,037,144), in view of **Timmons et al** (5,876,753) or visa versa, previously discussed in sections 9-10, 5, 3, 3 & 4 of the actions mailed 1/12/2005, 9/28/2005, 3/21/2006, 8/28/2006 & 5/17/2007, respectively.

While applicants' 6/15/2010 amendments to the claims have clarified their claimed process requiring the glycidyl methacrylate (GMA) to be in the pulsed plasma discharge as a **vapor** & explicitly requiring the GMA to form a polymer coating having epoxy functional groups thereon; these concepts were already encompassed in the applied rejections, hence the amendments have no significant effect on the applicability of the applied art rejections. Also as the requirement of applying "a power pulse..." does not exclude the typical pulsed plasma process of applying plural pulses, which may be considered encompassed by the present claim language, this modification of the claim language is also considered covered.

Applicants' 11/11/2009 claims required limitations for the pulsed plasma discharge to be from 30 seconds-20 minutes (as well as now canceled limitations of 2-15 minutes, or where the plasma discharge time may be 10,000  $\mu$ s (10 ms) to infinity). Since as previously discussed **Connell et al.**, who specifically shows plasma polymerization of vaporized monomers of glycidyl methacrylate, is not using a pulsed plasma & **Timmons et al.**, who does discussed the desirability of employing pulsed plasmas in

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order to retain reactive functional groups when performing plasma polymerization, does not use the specific monomer of applicants, the significance of the claimed time parameters was considered in view of the combination thereof, thus with respect to routine experimentation when employing the specific glycidyl methacrylate monomer vapor as suggested by Connell et al., using a pulsed plasma polymerization process as suggested by Timmons et al. for retaining functional groups inclusive of epoxy groups, hence it would've been reasonable for one of ordinary skill in the art to determine useful at times for applying pulsed plasma polymerization depositions dependent on desired coating thickness & other desired properties, as well as other plasma parameters, such as monomer flow rate, pressure, as well as specific average power density, all of which will affect required processing time, and none of which are defined by the claims, but given these considerations times in the claimed time range would reasonably be considered by one of ordinary skill. As previously discussed, length of time one performs any deposition process, inclusive of pulsed plasma depositions employing the claimed glycidyl methacrylate, will depend on many factors, such as desired thickness (unspecified by claims or specification), flow rate of deposition source (unspecified by claims, one example in specification, not relevant to claims), pressure (unspecified by claims), etc., where such parameters will affect the deposition rates (unspecified by claims or specification), such that the currently claimed times cannot be said to have any patentable significance due to significant lack of context, where furthermore it would've been obvious to one of ordinary skill in the art, to consider such known parameters, desired thickness & the like, and determined by routine experimentation the length of time required to effect a desired thickness of coating having reactive functional groups that are known to be desired as taught by Timmons et al., which would reasonably have been expected to include times as claimed.

As previously discussed, Applicants' independent claims require glycidyl methacrylate (GMA), instead of the broader polymerizable epoxy monomer of the previously claimed formula II of which GMA was a specific species, however the obviousness of using this particular species was



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previously considered & discussed as set forth below. Independent claim 1 also requires the pulsed plasma deposition conditions, where average power density of  $\leq 0.0025 \text{ W/cm}^3$ , which is the only pulsed plasma deposition condition required, and the only deposition requirements are that polymer growth occurs, such that epoxy groups are present in the coating in some unspecified amount.

As previously discussed, in **Connell et al**, see Fig. 1, p. 2, lines 26-53 & 87-128+ for plasma apparatus and parameters used in the plasma polymerization process, and see p. 2, lines 66-72 for a variety of monomers that includes epoxies, such as **glycidyl methacrylate** (line 70), which according to applicants' specification (p. 5, lines 6-8, which gives this compound as an example of applicants' formula III), and is now the specifically claimed compound in the independent claim. From the structure of glycidyl acrylate (p. 569 of Hawley's Cond. Chem. Dictionary, 12<sup>th</sup> ed), it was previously noted that the analogous methacrylate compound corresponds to applicant's formula (II), where  $R_1 = \text{CH}_3\text{C}=\text{CH}_2$ ;  $n=1$ , for the  $\text{CH}_2$  group.

While Connell et al teach plasma polymerization of claimed GMA monomers, they do not discuss use of pulsed plasma and parameters associated therewith, or reactive potential of resultant epoxy functionalized coated surface with a nucleophile, such as an amine or carboxylic acid.

**Timmons et al** teach plasma polymerization of monomers using continuous or pulsed plasma, where use of **low energy plasma**, as exemplified by a pulsed plasma of 200 W (over what volume is not given, but maybe assumed to always be the same volume & applicants hypothesize effective volume is  $943 \text{ cm}^3$  {page 9 of 11/11/09 response}) and on-off duty cycles of 3/5, 3/15, 3/45 and 3/60 ms, using allyl bromide to illustrate important principles of Timmons et al's process ((col. 6, lines 26-45 & Ex. 1 on col. 14), i.e. these *exemplary* conditions can not & should not be considered limiting to all the possible types of monomers that the reference suggest as useful) that a sharp increase in a bromine functional group content was seen in the film as the duty cycle during deposition was decreased, i.e. a 400% increase in bromine functional group content relative to carbon atoms at the 3/60 ms duty cycle (with applicants'

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hypothesis  $0.01 \text{ W/cm}^3$ ) compared to continuous (CW) plasma results. However, Timmons specifically suggest when discussing parameters generally, including power applied, that the nature of specific monomer will also affect the plasma variables employed (col. 7, lines 15-56, esp. 30-37), as may be further exemplified by their various examples, such as Ex. 5, desiring retention of the acid chloride group (-COCl), where again increased retention of the desired functional group was observed with **decreased power during deposition**, where striking retention was disclosed for average power below 5 W & particularly below 1 W (§ bridging col. 16-17), e.g. assuming applicants' hypothesize effective volume ( $1\text{W}/943\text{cm}^3 = 0.001 \text{ W/cm}^3$  &  $5\text{W}/943\text{cm}^3 = 0.005 \text{ W/cm}^3$ ), which may given applicants own analysis, be *reasonably considered to suggest the usefulness of starting with such average power densities when performing routine experimentations for oxygen containing functional groups, inclusive of claimed for oxygen-containing functional groups*, e.g. epoxy groups, especially considering that teachings of Timmons et al. specifically suggest that the nature of each monomer would reasonably require routine experimentation, thus it would have been **reasonable** for one of ordinary skill in the art to consider exemplary parameters for functional groups with **similar heteroatoms**, recognizing that the less stable the functional groups would reasonably have been expected to require employing lower average power densities. {With respect to the calculation of the volume of Timmons et al.'s plasma reactor provided by applicants, based on references supplied with the 11/11/2009 IDS, while the suppositions made by applicants may be considered reasonable, one cannot say definitively that the  $943\text{cm}^3$  volume was necessarily the volume of the plasma reactor used in the examples in Timmons et al., but it does provide a reasonable suggestion of considering use of claimed average power densities for oxygen containing functional groups.}

However, the present claims no longer require specific ON/OFF times, presently having no limit for ON times, or presently any range of OFF times (previously starting at  $10,000 \mu\text{s}$ ). It was previously noted that average powers for exemplary duty cycles for plasma polymerization using allyl bromide

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would be approximately 75W, 33W, 12.5W & 9.5W, respectively, but are for total power input, not power density, thus cannot be directly compared to the claimed parameter range, or applicant's tests, but would have been expected to show the same general trend as power density, which expectation remains consistent considering above comments with respect to hypothesize effective volume applied to values given in Timmons et al..

In Timmons et al., it is further taught to **use of such low energies to enable the deposited polymer to retain active functional groups** that can be **employed in a derivation reaction to covalently couple to these groups**, which are taught to **include various O-containing functionalization, including epoxy (table on col. 9)**. The derivatization is said to be a variety of nucleophilic displacement, which may use various **amino** containing materials that are a subset of the claimed amines. See the abstract; col. 3, lines 45-col. 4, line 38, esp. col. 3, lines 50-55 & 62-col. 4, lines 5, 24 & 30-38; col. 6, lines 15-col. 7, line 45+; col. 8, line 1-6; col. 9, lines 1-32. It would have been further obvious to one of ordinary skill in the art when employing the pulsed plasma process, to determine desirable ranges of pulsed plasma parameters for the polymerization reaction of specific compounds in a specific pulsed plasma apparatus via routine experimentation to provide an effectively low power plasma, as taught by Timmons et al, to enable retention of reactive functional groups, especially given their teaching on col. 7-8, that **different reaction chambers** provide additional **variables for determining parameters**, and employing taught power, on/off relationships or exemplary trends as a guide to power (& corresponding power density) and cycle time determination. It was noted that applicant specification does not actually disclosing the any explicit duty cycle ranges per se, but instead only a single specific ON time (20  $\mu$ s) & a range OFF times (broadened without support in the present claims), other than comparison to constant plasma generation, the **applicants' specification** does not provide any particular significance to either the specific examples or general ranges of ON/OFF time from which some possible duty cycles may be calculated, nor to the duty cycle in general, **considering determination of "pulsing arrangements" to**

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be “routine” (page 6, lines 17-18), hence no unexpected or critical results was seen to be taught in association with these on/off times or duty cycle values, especially considering the general concept is covered by Timmons et al., including in comparison to constant plasma generation.

While Timmons et al include epoxy-containing monomers in their teachings, exemplified by allyl glycidylether; they do not disclosure applicants’ particularly claimed GMA monomers. Also the particular claimed energy density range (or disclosed exemplary on-off time) parameters are not explicitly taught.

It would have been obvious to one of ordinary skill in the art to employ the pulsed plasma process in the deposition of Connell et al or the monomer, glycidyl methacrylate, in the process of Timmons et al, because in the first case, Timmons teaches the equivalent usage of continuous or pulsed for plasma deposition (abstract), but further provides advantages in energy control due to use of pulsed plasma, that generally enables retention of reactive functional groups & further use of the deposits for the claimed process of immobilizing a nucleophilic reagent without further modification, thus suggesting the desirability of pulsed plasmas & motivating their use instead of continuous plasmas, when retention of reactive functional groups, such as epoxy, is desired. Use of Connell et al’s monomer in Timmons et al’s process, would have been obvious, as it is consistent with the generic categories of useful compounds taught, capable of providing desired functional groups for the subsequent derivatization/immobilization reaction, and has been shown to be effectively deposited via plasma polymerization, which is the process employed by Timmons et al, thus providing motivation to employ the particular monomer source of GMA for epoxy functional groups.

It would have been further obvious to one ordinary skill to determine desirable ranges of pulsed plasma parameters for the polymerization reaction for specific monomers via **routine experimentation** to provide an effective low power plasma as taught by Timmons et al, especially given their teaching on col. 7-8, that different reaction chambers provide additional variables for determining parameters, and

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employing taught power, on/off relationships & exemplary trends as a guide to power usage (hence power density) and related cycle time determination, depended on the particular monomer to be polymerized & functional group to be retained. Note while Timmons et al provides some exemplary powers, they do not give power **density**, which can not be specifically determined or explicitly compared, if plasma volume is not known, but energy density is related to the above routine experimentation to determine parameters, hence would have been expected to be considered by one of ordinary skill and competence in the art.

Independent claims presently require "an average power density of the pulsed plasma discharge is less than  $0.0025 \text{ W/cm}^3$ " (previously narrowed from less than  $0.05 \text{ W/cm}^3$ ), & the claimed power density remains germane to the routine experimentation arguments. Hence, it remains considered that while the applied references do not provide values of power density *per se*, Timmons et al. was previously noted to provide **teachings on routine experimentation** to provide **an effective low power plasma** in col. 7-8. Particularly see therein lines 28-45 in col. 7, which discuss how the volume of the reactor chamber affects power density in plasmas of like power, stating "**large reaction volume** at a given applied power would also **provide increase retention of monomer functional groups**, as this variation in effect **decreases the power density** during plasma polymerization processes" (emphasis added), thus from the teachings of Timmons et al., it is considered that it would have remained clear to one of ordinary skill in the art to employ routine experimentation to adjust one's power density for the particular reagents employed, so as to provide desired retention of monomer functional groups as taught, which from the teachings of Timmons to effect low-power plasmas, that take into consideration volume & therefore power density, would have been expected to include optimization to relatively low powers, such as those within average power densities claimed, particularly for especially reactive functional groups like epoxy. The narrower claimed power density range was & is not considered to provide a significant differentiation from teachings of routine experimentation for essentially optimization purposes, especially as one of ordinary skill would realize that optimization values would vary depending on the particular functional group

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desired to be retained, with the general knowledge that epoxies are generally very reactive (i.e. easily reacted), so would have been expected to require lower energies than less reactive functional groups, & further considering that **applicants' specification** provides no determinable actual evidence or data for the superiority of the presently claimed average power density range, with or without combination with ON/OFF times over any other average power density range or cycle times used in another pulsed plasma (i.e. different plasma generating frequencies &/or pressures &/or temperatures, etc.), that can be **necessarily** derived from the specification as originally filed.

Applicants have previously alleged (bottom p.7, 12/30/2005 remarks) that Timmons et al. teach away from "low pulsed plasma discharge", however this "low" had no definitive meaning & their following discussion concerning pulsed low duty cycles is only indirectly relevant to the claims, as the previous unsupported duty cycle ranges were deleted from the claims, plus the current claims no longer even require any limitations to the timing of the pulses (only some off times). Applicants' previous discussion (top p.8, 12/30/2005 remarks) of depositions using "pulses of extremely low mean power (0.04 W)" with reference to Exs. 4 & 5 on p. 9, was noted to be inconsistent with the **applicant's specification's** examples, as none of the examples on p. 9-10, i.e. Exs. 1-9, have any teachings of "mean power", as they all provide only a "peak power = 40W", which even given the ON and OFF times of the plasma, does not provide sufficient information to calculate an arithmetic mean power, as **peak power** is the **highest value** reached, providing no other information on what percentage of the ON time is at peak power or instantaneous power values during the ON period, nor would such a value have any relevant meaning with respect to the present claim limitations, which relate to power density, thus require one to know the plasma volume. The examiner noted that  $< 0.05\text{W/cc}$  & the preferred range of  $< 0.0025\text{W/cc}$  was introduced on p. 6, lines 10-12, where the "average power of the pulsed plasma discharge" would in context more properly read --average power density...--, however the context of the specification would imply that this is the average power over the duration of the pulses only, because that's when the

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discharge is taking place, but discussion concerning duty cycle, which was Relevant to know canceled claim 7, suggest averaging over both the pulses ON-time and OFF-time. As the examiner noted no teachings of plasma volume for the particular taught ranges of (20 $\mu$ s ON)/(10,000-20,000 $\mu$ s OFF), she found no way to relate the claimed plasma power density values to the exemplary 40W peak power used with the exemplary ON/OFF times (20 $\mu$ s/20ms), hence the examples are not commensurate in scope with the claim limitations.

With respect to specification teachings relating to criticality of the pulsed plasma parameter of power density (i.e. < (0.05 or 0.0025) W/cc), the only place it was found to be mentioned was on p. 6, lines 10-12, where average power density was never particularly related specifically to any of the individual compounds, nor more than generally to the on-off times (i.e. duty cycle). None of the examples disclose what power densities were used to produce their results, only providing teachings comparing continuous wave plasma and pulsed plasma, where the pulsed plasma used specific parameters of a peak power of 40 W, with 20  $\mu$ s ON time/20 ms OFF time, which as discussed above provides no determinable significance to the power density in the independent claim 1. While the compositional data on the deposits comparing continuous plasma and pulsed plasma, show significant differences therebetween, those differences are consistent with & expected from the teachings of Timmons et al., who notes that as compared to continuous plasmas, pulsed plasmas are expected to increase retention of functional groups, such that one would have expected that an increased percentage of heteroatoms a functional groups, such as oxygen or increased percentage of the functional group itself, to remain. Thus applicants' experimental data (specification & declaration, see above discussion) is consistent with the expectations provided by the teachings of Timmons et al. for pulsed plasma versus continuous plasma, especially **lacking a clear showing** that this particular range of average **power densities** has a **significantly** different or unexpected effect or trend in the deposition of GMA, as compared to higher power densities also for pulsed plasmas (i.e. not just the expected trends & effects suggested by the

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teachings of Timmons et al., from two data points from insufficiently defined experiments essentially within the claimed range), or that GMA as compared to other epoxy monomers is significantly differently effected {e.g., such as producing different trends for the scope of the claimed process for GMA & comparison for AGE, but specification Exs. 1 & 4 are not commensurate in scope with the claims (see above concerning parameters) and insufficient data is present to determine any unexpected differences}, hence the examiner finds no patentable significance in this particular single parameter range for the claims as written, as it appears to be consistent with routine experimentation to optimize pulsed plasma parameters; expected taught trends associated with pulsed low-power plasmas; and lacking in generalized significance to the scope of all possible pulsed plasmas.

As was **previously noted** with respect to applicants' 6/30/2008 arguments concerning Timmons et al. & Connell et al., it appeared that applicants believed that each reference must be virtually a 102 in order to be combinable, however the demonstration of the equivalence of two epoxy compounds for plasma polymerization need not rely on both references having the same exact enduse {or presupposed that two different epoxy compounds would have the same optimized deposition parameters}, in order to provide a reasonable expectation that plasma deposition processes would have analogous results & that advantages of a particular variety of plasma processing, in this case pulsed plasma processing, which is taught to have an advantageous effect generically for functional groups on plasma polymerized monomers, would have reasonably been expected given the evidence of equivalent use in plasma polymerization depositions, to behave analogously. Applicants' previous apparent suggestion that in order to combine Connell et al. with Timmons et al., Timmons must disclose GMA (p. 5 of 6/30/08 response), simply makes no sense, since there would be no reason to combine Connell et al. to supply a teaching Timmons et al. already had. Applicants appeared to apply the same illogic to the rejections that combine Timmons et al. with Kolluri et al. or Chabreck et al. (p. 8 of the 6/30/08 response). Applicants' discussion on ps. 6-7 of their 6/30/2008 response continued to rely on unclaimed parameters & discussion



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that is not commensurate in scope with claimed requirements. The examiner found that a particular calculation for average power as cited by applicants at the top of col. 8 in Timmons et al., is no way inconsistent with the claim of average power density by applicants, since while not the same, average power & average power density are related {divide average power by plasma volume = average power density}, thus the teachings in no way negates the need or expected usefulness of routine experimentation for a particular monomer & apparatus. The examiner agreed with applicants' statement "...that straightforward extrapolation from the Timmons plasma polarization conditions to the presently claimed powers does **not** necessarily lead to **unexpected** results" (emphasis added, p. 7 of 6/30/08 response), but cannot agree that no unexpected results demonstrate any novelty or unobviousness.

Applicants' **previous** arguments (6/30/2008) concerning deposition using GMA versus AGE, by which the examiner presumes they were referring to their specification's figures 2 & 8 from examples 1 & 4, respectively, as has been previously pointed out to applicants, does not provide data which is commensurate in scope with the claims, hence provides no clear evidence with respect to the patentability of claimed limitations. That 2 different epoxy monomers provide different IR spectra when treated in the like pulsed plasma peak power & on/off times (methodology of the example 1 said to be used in example 4, thus presumably like temperatures, pressures, frequencies etc. were used, although not restated), gives only a single data point, which as previously pointed out by the examiner cannot be clearly related to the claimed limitations due to the lack of correspondents between claimed power densities & information provided concerning the experimental parameters. Furthermore, as these two epoxy monomers **have different overall chemical structure**, one of ordinary skill & competence in the art would **expect** different optimization for their use in pulsed plasma deposition due to expected different activation energies, etc., required for reaction, when one wants, as was shown to be known & desirable in the prior art, to retain the epoxy functional group, thus this single comparison under energy conditions that cannot be properly compared to those claimed (or even if they were commensurate ), as a single data point

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cannot show relevance to the metes and bounds of the claimed average power density parameter range for all possible pulsed plasmas.

Applicants argued "it is surprising that low powers could lead to such high levels of reactive epoxy groups in the polymer coating" (1st full ¶ of page 7 of 11/11/09 response), however applicants claim no particular levels of epoxy groups in their polymer coatings in any of their claims, and given above discussed teachings of Timmons teach with respect to using lower powers to increase the number of reactive functional groups, thus the use of low powers is not surprising in producing larger amounts a functional groups, of whatever types, it is expected.

Applicants' arguments (page 11 of 11/11/09 response) with respect to the variable duty cycle disclosures in Timmons et al., are absolutely irrelevant with respect to the present claims as written, since nothing in applicants' claims prohibits employing an *initially* higher average powers when depositing on a substrate, as long as sometime during the pulsed plasma deposition of the claimed glycidyl methacrylate, the claimed average power densities less than  $0.025 \text{ W/cm}^3$  is employed & retains functional epoxy groups, as a substrate on which previous plasma polymerization has occurred, is still a substrate; or a single ON/OFF sequence having a progressive variation of duty cycles, is still a sequence or this arbitrary designation could also be applied to all pulsed plasma deposition at a single duty cycle, nor are the teachings of Timmons et al. as discussed in col. 12 necessarily limited to their teachings of employing a gradation of duty cycles in order to effect better adhesion with the initial deposit & increased retention of desired functional groups at the surface with decreased duty cycle.

Applicants' CLAIMS only require that the coating produced contains some epoxy groups, how little or how many is unlimited (*may or may not be limited by the one parameter of power density, as how other unclaimed parameters affect the epoxy retention cannot be determined*), thus any arguments with respect to amounts epoxy functional groups *remain* totally irrelevant to applicants' claims as written. The claimed average power density does not necessitate any particular concentration of claimed epoxy groups

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in the claims as written, especially not considering all the new matter applicants have presented in their new claims, which are not commensurate scope with examples in the specification, hence no results that might be inferred for those examples with respect to epoxy functionalization amounts are relevant to the claims as written.

Applicants previously asserted that remarkable adhesive properties are shown by their Ex. 3 (¶ bridging p. 7-8 in the 11/11/2009 response). While Ex. 3 merely discusses generically that "two glycidyl methacrylate plasma polymer coated strips of polymer film (polyethylene, PE ICI, 0.80 mm thick, or polytetrafluoroethylene, PTFE, Goodfellow, 0.25 mm thick)", were treated in this example, it does for further figures 5 & 6, which if you backtrack, indicates on p.10 that the pulsed plasma employed 20  $\mu$ s on, 20  $\mu$ s off, with peak power of 40 W for an undisclosed amount of time, thus this example while providing deposition examples on different substrates in Ex. 1, does not broaden the data with respect to the pulsed plasma in the specification, which does not specify what average plasma density it was used for the examples therein, as Ex. 3 uses the same parameters but lacks information with respect overall time. Two data points present in section 7 of the 2/13/2009 declaration encompassing the claimed endpoint & 1 other point, as previously discussed, are insufficient to provide significance to all average power densities of pulsed plasmas in the claimed range, since there is not even any information with respect to any other parameters, hence how plasma pressure, a monomer flow rate, treating already deposited monomers, etc. (e.g. all the various undefined parameters encompassed in the scope of applicants claims), will affect retention of the claimed epoxy groups (e.g. two data points do not a trend prove, especially with insufficient context). Thus we are simply left with whether employing lower powers, or more properly lower average power densities (since comparing absolute power values is relatively lacking in meaning), would have reasonably been expected to enable retention of functional groups, specifically epoxy functional groups -- this concept is well established in the art, as seen in above discussion. The specification & declaration lack clear showing that the claimed average power density is

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significant with respect to all possible pulsed plasma parameters it may be employed with when using glycidyl methacrylate in the scope claimed.

While applicants' claims & arguments appear to not recognize that other plasma parameters will affect the relevance of any single parameter to the overall results, including power, this concept is well recognized by those ordinary skill in the art & specifically discussed by Timmons et al. who states "... as anyone who is well-versed in the practice of plasma polymerization will recognize, the correlation between applied electromagnetic power in the plasma generated film composition is complicated by the fact that many other process variables must be simultaneously considered. These additional variables include such factors as the size (e.g. volume) of the reactor, the location of the substrate relative to the plasma discharge zone, the monomer flow rates, the monomer pressure, the nature of the monomer, etc. For example, it is well known that increased monomer functional group retention can be maintained at a given power by increasing the monomer flow rate... Likewise, the use of a large reaction volume at a given applied power would also provide increased retention of monomer functional groups, as this variation in effect decreases the power density during the plasma polymerization process..." col. 7, lines 25-58. Given the paucity of information concerning no important plasma parameter variables provided by applicants' claims, specification (esp. relevant to scope claimed) & the 2/13/09 declaration, it is impossible to conclude that choosing one known plasma polymerization monomer + the claimed average power density in absence of all other critical parameters, provides a results which is necessarily unexpected for all claimed power densities under all conditions, or even that it is unexpected for any, as one would, given teachings as discussed above, generally expect pulsed power, especially at lower pulsed power densities to provide a greater retention of reactive functional groups, especially if one does not even need to be concerned about any other characteristic of the coating, such as adhesion, etc.

7. **Claims 28, 30 & 43-44** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Timmons et al** ((753), discussed above in section 5), in view of **Kolluri et al** (5,723,219), previously

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discussed in sections (10 & 12-13), (3 & 5), 5 & 6 of the actions mailed 1/12/05, 3/21/2006, 8/28/2006 & 5/17/2007, respectively, and reiterated below.

As noted above **Timmons et al** teach allyl glycidyl ether (AGE) as an **exemplary epoxy-** containing monomer, instead of the claimed epoxy compound of GMA, but **Kolluri et al** also teach analogous plasma polymerization reactions, where either **AGE or GMA** are taught to be **deposited for their reactive epoxy functional groups**, hence use of GMA in Timmons et al would have been expected to be effective for the taught process due to taught equivalent usage, providing an alternative species for the generically taught epoxy containing monomers. Above discussions of routine experimentation are equally applicable in this combination, as previously noted, including expected need to optimize for each individual monomer that contain like functional groups desired to be retained.

In **Kolluri et al.**, specifically see the abstract; col. 2, lines 35-57+ for prior art plasma polymerization and its limits; col. 3, lines 5-26 for background discussion of **pulsed plasma polymerization to preserve functional groups** in deposited films; summary for sequential plasma depositions; col. 5, lines 40-49 for classes of monomer including **epoxies**, with lines 47-48 teach allyl glycidyl ether, **glycidyl methacrylate** (GMA), etc; col. 6, lines 5-30 teaching various amines & lines 60-67 plasma in general to plasma deposit monomeric compounds as sources of named functional groups; col. 7, **table I** gives surface functional groups, where the functional group remaining on the surface for 1<sup>st</sup> plasma deposited layer is in the first col. of table I, and what it reacts with in the 2nd col., with what's produced in the last col., where #13 and 14 give specific examples that react amines functional groups with epoxy functional groups on the surface (i.e. epoxy group reacting with alkylamines or dialkylamine generically, as well as ROH); col. 8, line 62-col. 9, line 14, esp. 3 and 10-11 with such suggested combinations; cols. 9-15+ with specific examples noting plasma may be pulsed (col. 9, line 50; col. 10 line 52; col. 12, line 56-57, etc); col. 16, line 30-60; & col. 20, line 18-col. 21, line 23 discussing and

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illustrating first plasma deposition using GMA, then plasma depositing an amine thereon via reaction with the epoxy group; and claims 1, 4-6, etc.

Kolluri et al. teach epoxy functional groups as one of a possible first group of functional groups to be deposited by plasma polymerization, generally teaching a second vapor deposition via plasma to attach second functional groups reacted to the first functional group, where the second functional group includes carboxy, carboxylic ester, hydroxy, etc., where taught monomer sources for carboxylic acid functional groups include acetic acid (claims & col. 6, lines 31-40), however Kolluri et al. does not specify trifluoro acetic acid, nor particularly reacting epoxy & carboxylic acid groups. Kolluri et al. also teach a wide variety of monomer sources for amines functional groups, inclusive of various primary amines & other alkylamines, e.g. ethylene amine, ethylene diamine, etc. (col. 6, line 5-30), but does not discuss solution chemistry for depositing/reacting with the secondary functional group.

Applicants have **previously** objected to Kolluri et al. because the epoxy group is only one example of various functional groups that may be plasma deposited, however suggesting alternative functional groups in no way negates the teachings of the usefulness or the effectiveness of plasma polymerization to achieve epoxy functionalized coatings. Additionally note, while Kolluri et al. do not explicitly teach that pulsed plasma is used with the deposition of GMA monomer, they do explicitly teach that the plasma depositions produce coatings that retain functional groups, which in the case of GMA is epoxy group (col. 16); they do generally teach that pulsed plasmas may be used; & explicitly state on col. 3, lines 9-25 that "pulsed plasma has been employed with variable duty cycle to preserve the functional groups of films during deposition using plasma polymerization... It is **known** that the **power applied**, the **frequency of the pulse**, and the **duty cycle** can be **varied to preserve the functional nature** of the deposited film..." (emphasis added). Thus, while pulsed plasma may not be explicitly mentioned as used with the specific monomer GMA, the suggestions & advantages of employing pulsed plasma deposition in Kolluri et al. would clearly suggest to one of ordinary skill & competence in the art the advantages

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thereof, especially as combined with Timmons et al., who further elaborates on the advantages of pulsed plasma for functional group retention and parameters generally important therefore. Note that Kolluri et al. differs from the independent claims by not suggesting specific average power densities for their suggested pulsed plasmas, thus also not suggesting average power densities for the specifically taught GMA monomers, but like Timmons et al., they have teachings that suggest routine experimentation is expected for determining appropriate parameters for preservation of the functional nature of the deposited film, so these references are consistent with each other & continue to be considered as suggesting to one of ordinary skill in the art that the use of pulsed plasma, plus the choice of power density for preservation of a particular functional nature for a particular monomer would have been expected to be a matter of routine experimentation, lacking any clear evidence to the contrary.

As **previously discussed** with respect to Applicants' 6/30/2008 argument (page 8) that a single exemplary use of pulsed plasma in step 2 of Ex. 1 at 100 W power & pulsed at 10 Hz with a 10% duty cycle (no plasma volume given, thus no power density can be necessarily determined, but it's a 4.0 liter plasma reaction chamber, so average power density could be a minimum of about  $(100 \text{ W} \times .10)/4.0 \text{ L} = 0.0025 \text{ W/cm}^3$ ) using acrylic acid monomer, somehow determines all pulsed power usage as taught by Kolluri et al., fails to provide any convincing arguments therefore (or why a single power usage, with power density unknown, should be considered a necessary difference from power density of the claims, particularly considering the 4.0 L plasma chamber), especially considering this example is for plasma polymerization of acrylic acid optimized to retain acid functional sites, where applicants have provided no rationale why one of ordinary skill in the art would necessarily apply an optimization for acrylic acid to the alternative options using epoxies (probably more reactive), such as examples using GMA as found on col. 16 (formula 19, lines 30-45) or col. 20 (lines 30-55), when col. 3 as previously pointed out, so clearly suggests optimization dependent on the nature of the functional group being deposited and maintained. It would be reasonable to consider the acrylic acid parameters as a rough starting point for routine

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experimentation, given both have oxygen functionalities & no other specific examples that are closer, however one would not consider simply the exemplary power applied without consideration of the volume over which it is applied, nor the expected difference in reactivity of the functional group to be retained, as was done by in applicants' arguments.

8. **Claims 28, 30 & 43-44** are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Timmons et al** ((753), discussed above in section 5), in view of **Chabreck et al.** (WO 98/28026), previously discussed in section 9 of the action mailed 5/17/2007.

**Chabreck et al.** provide teachings concerning plasma polymerization mechanisms for unsaturated (i.e. vinyl groups, p.9) monomers carrying reactive groups, such as epoxies, where it is desired to retain the reactive groups or functionalities on the plasma polymerized coating, where the last paragraph on p.4 teaches that epoxy groups are particularly susceptible to plasma decomposition. Chabreck et al. teach that controlling & retaining the functional groups on deposits of the plasma polymerized unsaturated monomers with reactive groups, such as GMA (p.33, Ex.B-5), is effected by use of the afterglow of the plasma, which is mechanistically equivalent to the off-time in a pulsed plasma process. Additionally, when discussing useful plasma parameters, Chabreck et al. teach that the plasma is preferably "an inductively coupled, pulsed radio frequency glow discharge plasma" (page 11, especially last two lines). Chabreck et al. further teach that their primary plasma polymerized coatings with reactive groups, such as epoxies, **may be further reacted**, such as with solutions where the compositions have groups reacted with the retained reactive group of the polymerized coating. Exs. C-14 & C-15 on page 38 employ the plasma polymerized coating of GMA to **react with solutions** of "4-amino-Tempo" or "Jaffamine ED2001", which appear to be tradenames for **amine-containing** compounds. Example C-14 is particularly of interest for employing an alcohol based solvent (isopropanol/water 4:1) in which the plasma modified at substrates were soaked for extended periods of time. In Chabreck et al., further see the abstract; 1st ¶, p.1; p. 3-6, esp. the ¶ bridging p. 5-6+ following ¶; p. 7, 3rd full ¶, noting suggested



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amine-containing molecules for the top or secondary coating, such as aminoalkanes like methylamine ; p.12, esp. ¶ bridging p.12-13; paragraph bridging p. 16-17 through p. 19, esp. top & middle ¶ p.17.

Given the above teachings of Chabreck et al. on the need to protect functional groups like epoxies on monomers, such as GMA, from the decomposition effects of plasma in order to provide plasma polymerized epoxy functionalized coatings to be used for further reaction was secondary coating solutions that may contain amines, it would have been obvious to one of ordinary skill in the art to employ unsaturated epoxy containing monomers, such as GMA, in the pulsed plasma process of Timmons et al. as discussed above, as Chabreck et al. indicate that GMA requires protection from the decomposition effects of an *in situ* continuous plasma in order to provide plasma polymerized depositions that retained the epoxy functional group, while simultaneously indicating that pulsed plasmas that employ the afterglow from the plasma discharge will both enable such retention of epoxy functionalities in the deposited coating and effectively polymerized the GMA, hence the examiner takes notice that one of ordinary skill in the art would recognize the correspondence with the pulsed plasma teachings of Timmons et al., which recognize the superior retention of functional groups in general when using pulsed plasmas versus continuous plasmas, as well as the resultant coatings usefulness for reacting with secondary coatings, such as amines, and thus apply the above discussed teachings of routine experimentation in Timmons et al. to determine effective pulsed plasma parameters for GMA used in Timmons particular pulsed plasma polymerization deposition technique, as Chabreck et al. provides motivation therefore by explicitly suggesting that analogous treatment is necessary with GMA monomers for functional group retention.

Applicants' 3/30/2008 arguments with respect to Chabreck et al., failed to address the reasons for obviousness presented by the examiner, as their arguments appeared to equate a remote plasma as having the same effect as an *in situ* continuous plasma, which is contrary to the teachings of Chabreck et al., & with which one of ordinary skill in the art would not agree, since no plasma is being actively

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produced at the deposition site, so that when depositing, the conditions are more analogous to the off-time during a pulsed plasma, than the on-time.

9. The reference of **Tatsukami et al.** (4,166,079) remains of interest for particular reactions of epoxide groups with diethyl amines, as was previously set forth in now canceled claim 41. It was previously noted that while all the above combinations suggest further functionalizing or reacting functional groups retained via plasma polymerization depositions, thus suggesting employing such processes with retained epoxy functional groups, as well as suggesting that such further reactions may be with amines, none of the above references suggest employing a solution of diethylamine in methanol for 24 hours to effect a 59% reaction of the epoxy groups on the polymer coating, however to **Tatsukami et al.** demonstrate that it is an old and well-known reaction to perform "aminating" of glycidyl acrylate copolymers using a solvent mixture of amines & a lower alcohol, where lower alcohol may be methanol & the amines may be a secondary amines, such as dialkylamines like diethylamine (abstract; col. 2, lines 28-col. 3, line 26, esp. 4 & 12; & col. 4, lines 4-10). In col. 2, lines 59-68, Tatsukami et al. note that the aminating reaction may take a long time to complete with epoxy groups, thus teach means to shorten the process by optimization of solution, temperatures, etc., as long reaction times are considered not advantageous industrially. It would've been obvious to one of ordinary skill in the art to employ aminating procedures as taught by Tatsukami et al. on the plasma polymerized GMA resulting from the above combinations, given the teachings of the above combinations of references, such as Timmons et al.'s (col. 9-10) suggestion of plasma depositing polymers with intact functional groups (e.g. including epoxy) for further chemical derivations (e.g. including amine groups, as discussed above), especially with further consideration of Kolluri et al. explicitly suggesting the reaction of retained epoxide groups with secondary amines (e.g. table 1, #14) or Chabreck et al.'s examples C-14 or C-15 that react a glycidyl functionalized substrate with an amine solution, including alcohol based ones (both also discussed above); as the above combination of references show & suggest the desirability of aminating the resultant

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epoxide plasma polymers, with Kolluri et al. specifically suggesting dialkyl amines, while alternatively Chabreck et al. explicitly suggests using solution treatments for derivations. Tatsukami et al. clearly shows the reasonable expectation that a diethylamine methanol solution will effectively react with a plasma polymer derived from GMA, as it may be considered reasonably equivalent to the ethylene-glycidyl acrylate copolymers treated by Tatsukami et al., who thus provides reasonable instructions for optimizing the animation process, for both completeness of reaction & time required to perform it.

10. The references of **Mitscher** (4,374,979) or **Hammar** (4,578,405) remain of interest for reaction of epoxy groups with trifluoroacetic acid vapor, as was previously discussed with respect to now canceled dependent claim 40. As previously set forth, while all the above combination suggests further functionalizing or reacting functional groups retained via plasma polymerization depositions, thus suggesting employing such processes with retained epoxy functional groups, as well as that further functionalization may be via vapor reactions, the references do not specifically suggest treating a epoxide functionalize surface with trifluoroacetic acid vapor for 30 minutes to react 89% of the epoxide groups in order to produce a reacted surfaces having unspecified functional group results (e.g. reacted, how doesn't matter). However, as noted above Kolluri et al. teach epoxy functional groups as one of a possible first group of functional groups to be deposited by plasma polymerization, generally teaching a second vapor deposition via plasma to attach second functional groups reacted to the first functional group, where the second functional groups includes carboxy, carboxylic ester, hydroxy, etc., where taught monomer sources for carboxylic acid functional groups include acetic acid (claims & col. 6, lines 31-40), however Kolluri et al. does not specify trifluoroacetic acid, nor specifically reacting epoxy & carboxylic acid groups.

While the above combination provides the specific suggestions of reacting epoxide groups from plasma polymerized GMA with various vapor phase amines, it also provides the more generalized suggestion to perform further vapor phase reactions that form other derivative, as the suggested process is

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not limited to the specific suggested examples, but providing a generally applicable technique. Epoxy groups are old and well-known to be reactive with trifluoroacetic acid (TFA) as shown by **Mitscher** (col. 5, lines 40-56; col. 8, lines 16-24 & col. 14, lines 50-60; employing TFA to open the epoxy ring to form keto groups) or **Hammar** (abstract; col. 5, lines 9-15; col. 9, lines 10-30, providing trifluoroacetic functionalization by reacting the epoxide group in glycidyl acrylate or glycidyl methacrylate), hence it would've been obvious to one of ordinary skill in the art, given known chemical reactions to employ TFA for further functionalizing the epoxide groups from plasma polymerized GMA from the above combination, to employ further vapor phase reactions as suggested by Kolluri et al., with the reasonable expectation of providing useful reacted surface, such as keto groups or further trifluoroacetic functionalization, dependent on routine experimentation to determine effective reaction parameters (e.g. temperature, vapor pressure, reactant partial pressure, etc....) for producing particular results (note claims are lacking in requiring any specific results & the specification is lacking in means to effect any particular results).

11.           **New art** of interest that includes: **Schultz et al.** (2010/0092695 A1, not prior art) with teachings of improving adhesion on carbon fibers employed processes inclusive of grafting & polymerization using epoxy acrylate resins, with mention of use of pulsed RF plasmas; & **Badyal et al.** (2009/0318609 A1) to overlapping inventors directed to plasma deposition of unsaturated polymerizable compounds having nitrogen containing groups, inclusive of acrylates thereof, where pulsed plasma is using average power density & on/off times parameters as presently claimed & taught may be employed therefore.

**Other art of interest previously cited** included: **Timmons et al.** (2009/0240013 A1), which while not prior art, is relevant to the state-of-the-art; & **Miura et al.** (JP 62-80644 A), who provides further teachings on treating polymers having epoxy groups with fluoroacetic acid (abstract).

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As stated in section 6 of the 9/28/2005 action, it remains noted that FR 2,581,991 to **Delfort et al** cited by PCT, continues to provide cumulative evidence that the amine groups provided to the active epoxy functional groups on the coated surface, would have been expected to proceed in a covalent coupling reaction or derivatization at the site of the epoxy as suggested and claimed, as well as providing further evidence of the known desirability of such reaction products.

As previously cited, **art of interest** included: **Kokaku et al.** (4,863,557: col. 3, lines 3-16 & col. 4, lines 4-22; & PN 4,560,641; col. 3, lines 39-68, esp. 63-67 & col. 6 Exs. 5 & 6), who teach GMA & AGE or glycidyl vinyl ether as used equivalently for plasma polymerization deposition; and **Taguchi et al.** (2003/0124382 A1), who in [0039] terms glycidyl acrylate, GMA & AGE, as all being classed as epoxy-containing vinyl monomers, thus all showing expectations of analogous chemistry &/or analogous plasma polymerization reactions. Note that Kokaku et al. (557), while not teaching the necessity of having remaining epoxy functionalities, nor pulsed plasma, does indicate that for their 13.56 MHz HF plasma at monomer pressures of 0.01-5 Torr, that appropriate ranges of plasma density (for area, not volume) include 0.01-10 W/cm<sup>2</sup>, which is not quite the same parameter as claimed, noting inclusion of a third dimension would likely produce overlapping parameter ranges. Similarly, **Yokura et al.** (JP 01-171856) performs plasma polymerization, particularly of acrylic or methacrylic compounds having a glycidyl group, where the English abstract particularly exemplifies glycidyl methacrylate preformed at pressure = 0.12 Torr & a power density discharge of 400 Wmin/m<sup>2</sup> (again based on area not volume), which is equivalent to 0.04Wmin/cm<sup>2</sup>, thus it is noted that it is old and well-known in the art to employ relatively low power density is for plasma polymerization of GMA, even when there is no necessity in the teachings stating the desirability of maintaining the presence of the glycidyl (= epoxy groups) on the surface of the deposited layer, hence these references can be considered to provide evidence in support of or cumulative to the above discussed teachings of Timmons et al., as combined with the above rejections, as a person of ordinary skill in the art when employing the teachings of routine experimentation would

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have reasonably considered such known power densities as maximum starting points for routine experimentation for preserving epoxy groups on GMA, given teachings suggesting that retention of the epoxy groups require lower power. It would be a matter of competence for a person of ordinary skill to consider variation in plasma parameters of particular reagents based on known parameters for related plasma polymerizations in combination with Timmons teachings on how to preserve functional groups on plasma polymerized depositions.

Also, **Hitachi LTD**'s JP 58-66938, as indicated by its 2007 Derwent abstract was found to be of interest for plasma polymerization of materials intended to be far-UV sensitive, where the abstract specifically indicates glycidyl methacrylate as being a useful material therefore, but the abstract contains no information on whether or not pulsed plasmas were contemplated, nor whether or not the plasma polymerized deposit contains reactive epoxy groups.

12. **Claims 28, 30 & 43-44** are provisionally rejected on the ground of nonstatutory **obviousness-type double patenting** as being unpatentable over claims 1-2, 10, 12-13, 18-19, 20-24, 27-30 & 37-44 of copending in view of Application No. **11/919,185** ( $\equiv$  2010/0055413 A1, Badyal et al.), in view of **Timmons et al** (5,876,753), optionally further in view of **Connell et al** (UK 1,037,144), or **Kolluri et al** (5,723,219), or **Chabreck et al.** (WO 98/28026), all discussed above.

Copending **application (185)** claims a method of providing a surface of a sublayer with a desired chemical functionality, wherein a chemically distinct material is applied to form a further layer or toplayer on this underlying surface in its independent claim 1, with dependent claims requiring that the sublayer be a chemically reactive polymer, such as poly (glycidyl methacrylate) & the further layer attached thereto may be amine terminated biomolecules (claims 10 & 12-13). Copending (185) has further limitations, where the sublayer may have properties of specific chemical reactivity, adhesion &/or the ability to selectively bind biomolecules (claims 18-19 & 27), as well as depositing sublayer with a nonequilibrium plasma or where the sublayer may be plasma polymers deposited via a pulsed plasma

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with separate parameter teachings of employ an average power of 50 W & employing a pulsing sequence where power is on for 10-100  $\mu$ s & off for 1000-20,000  $\mu$ s (claims 29 & 37-44). Thus, the limitations of copending (185) encompass those of the present claims, but are broader in that they do not particularly specify that the poly(glycidyl methacrylate) was deposited via pulsed plasma with claimed average power density or time ranges, nor that the chemical functionality is epoxy. However, in particularly specifying that the sublayer polymer of poly(GMA), the implication of this nomenclature is that the polymer formed has multiple epoxide functionalities, and that the epoxy group would be retained, plus the claims provide a reasonable expectation of GMA deposited via claimed pulsed plasma techniques, which would have been especially obvious to one of ordinary skill in the art in view of the teachings **Timmons et al.** (discussed above), who indicates that pulsed plasmas are particularly advantageous for retention of reactive functional groups, as one of ordinary skill of the art would readily recognize to include epoxy, including where those reactive functional groups are intended for subsequent reactions. Furthermore, while the pulsed plasma parameters of these claims are disclosed for generic use in depositing polymers with desired chemical functionalities, do not include overall times, and the claimed average power is a less meaningful parameter than the average power density of the present claims, one of ordinary skill the art would recognize that average power is particular to the specific apparatus, plus that both processing times & average power densities for a needed to be determined for any deposition, so would have considered these claimed parameters when applying routine experimentation for the particular precursors for pulsed plasma polymerization processes, inclusive of the claimed production of poly (GMA). Optionally the secondary references of **Connell et al** (UK 1,037,144), or **Kolluri et al** (5,723,219), or **Chabreck et al.** (WO 98/28026), all discussed above, provide further motivation for the reasonable expectation of employing GMA in a plasma polymer deposition, with the expectation of retaining epoxy groups as the desired functionality.

This is a provisional obviousness-type double patenting rejection.

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13. Applicant's arguments filed 6/15/2010 & discussed above have been fully considered but they are not persuasive.

To reiterate, the evidence of the declaration & the originally filed experiments, are insufficient in quantity & in the information they provide to enable evaluation with respect to the scope of the claim, as has been repeatedly discussed, and supplying opinions in a declaration does not correct this deficiency. The examiner has not said that the evidence provided proves routine experimentation (although the skimpiness of this evidence certainly suggests routine experimentation), but that the evidence provided it's too incomplete & too little to warrant the conclusion of unobviousness & overcome the reasonable expectation provided by Timmons et al., in view of various secondary references Connell et al (UK 1,037,144), or Kolluri et al (5,723,219), or Chabreck et al. (WO 98/28026), which reasonably suggest application of routine experimentation to optimize for pulsed plasma polymerization deposition using GMA. Applicant's arguments that have focus on particular depositions in Timmons et al. using monomers with completely different functional groups, continued to be extremely unconvincing, especially as epoxy groups in general would reasonably have been recognized by one of ordinary skill in the art as being some of the most sensitive or unstable or most likely to react if care is not taken in their deposition, where the teachings of Timmons et al. reasonably provide one of ordinary skill yard with the tools for routine experimentation for preserving desired functional groups such as epoxy, where one of ordinary skill yard would not necessarily consider themselves limited only to the specific compounds discussed in Timmons et al., as has been discussed repeatedly. Also as previously noted, applicants own specification teaches that determination of pulsing arrangements can be determined by routine methods in any particular case, thus lacking **clear** evidence of unexpected or particularly significant results for a particular pulsing parameter range, applicants' own specification can be considered to suggest routine experimentation.



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14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

15. **Any inquiry** concerning this communication or earlier communications from the examiner should be directed to **Marianne L. Padgett** whose telephone number is **(571) 272-1425**. The examiner can normally be reached on M-F from about 9:00 a.m. to 5:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached at (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Marianne L. Padgett/  
Primary Examiner, Art Unit 1792